

FY2016
ANNUAL ACCOMPLISHMENTS REPORT
FOR INVENTORIES AND VITAL SIGNS MONITORING
NORTHEAST COASTAL AND BARRIER NETWORK (NCBN)

Sara Stevens
Program Manager

Northeast Coastal and Barrier Network FY 2016 Accomplishments Report

I. Overview

The Northeast Coastal and Barrier Network (NCBN) includes eight parks located along the Atlantic coast from Massachusetts to Virginia: Cape Cod National Seashore (CACO), Fire Island National Seashore (FIIS), Sagamore Hill National Historic Site (SAHI), Gateway National Recreation Area (GATE), Assateague Island National Seashore (ASIS), George Washington Birthplace National Monument (GEWA), Thomas Stone National Historic Site (THST), Colonial National Historical Park (COLO). These parks contain critical coastal habitat for many rare and endangered species, as well as migratory stopovers, acting as essential corridors for birds, sea turtles, and marine mammals. They also protect vital coastal wetlands, essential to water quality, fisheries, and the biological diversity of coastal, near shore, and terrestrial environments.

All NCBN parks continue to be pressured by encroaching development, intense recreational activity, and the results of climate change; sea level rise, increased storm intensity, amplified variability in surface and groundwater levels, and ocean acidification. These are expected to be among the most pressing natural resource management challenges in the near future. In addition, being within the urban sprawl of the Northeast creates additional pressure on these sensitive and often last remaining pristine ecosystems.

The NCBN Inventory and Monitoring Program, developed to provide parks with credible, defensible scientific information, will help managers and scientists track the changes that occur in condition of their park's natural resources. As part of the National Park Service's original effort to "improve park management through greater reliance on scientific knowledge," the Cape Cod Ecosystem Monitoring (CCEM) program, an NCBN park, was established to develop and implement a long-term monitoring program that would serve to aid park managers in making sound stewardship decisions. The program at CACO was established in the early 1990's as one of the few "Prototype" parks tasked with developing a monitoring program for coastal parks. As part of this process, the CCEM program adopted an ecosystem-based, issue-oriented approach for monitoring ecosystem integrity, working closely in partnership with the USGS-Biological Resources Division. CCEM developed monitoring protocols based on the issues identified in Roman and Barrett's 1999 report *Conceptual Framework for the Development of Long-term Monitoring Protocols at Cape Cod National Seashore*. Not long after, in 2000-2001, the NCBN Monitoring Program was established as part of the newly formed and funded NPS Inventory and Monitoring Program (NPS I&M). The NCBN program extended the Cape Cod CCEM program by building the Network monitoring plan on the same approach for the additional seven network parks.

The following report provides a summary of accomplishments for FY16 on inventory and monitoring projects being developed and implemented by the NCBN program. In FY16, the network received a total of \$957,300; this includes \$800,000 in Vital Signs Monitoring funding, and \$82,300 from the NPS Water Resources Division, and \$75,000 in IMD funding to support data management activities for additional Hurricane Sandy projects that the NCBN is lead on.

FY16 Summary

Vital Signs Monitoring continued in FY16 with salt marsh vegetation and nekton monitoring occurring at Assateague Island NS (ASIS), Colonial National Historical Park (COLO), and Gateway National Recreation Area's Sandy Hook Unit (GATE-SHU). A four-person crew consisting of one Pathways Intern, one Biological Science Technician, and two Geoscientists-in-the-Parks interns conducted the monitoring under the supervision of Network Biologist, Erika Nicosia Rocks.

Sediment Elevation (SET) data was collected at 145 SET sampling locations, two times at each location during the year by NCBN biologist, Jim Lynch, with the assistance of other NCBN and park staff. SET data was collected in nine parks, including 2 parks (ACAD, BOHA) in the Northeast Temperate Network and 2 parks (NACE, GWMP) in the National Capital Region Network. In collaboration with NOAA and USGS scientist the Network completed and published the NCBN SET monitoring protocol. The three agencies worked together to develop the protocol that has already been adopted widely by other agencies, organizations, and institutions interested in monitoring surface marsh sediment elevation.

The NCBN citizen science marsh bird monitoring program was implemented for the fourth year at COLO and fifth year at CACO, and for the second year at GATE. Our partnership also continued with the Saltmarsh Habitat & Avian Research Program (SHARP), founded by a group of academic, governmental, and non-profit collaborators to provide critical information for the conservation of tidal-marsh birds. Half way through the fiscal year, Dana Filippini left her position as Marsh Bird Program Lead for NCBN to take a new Biologist position at GATE. Because field season had already started, we continued to collect the marsh bird data to finish out data collection for the year.

The network also developed and/or continued cooperative efforts with the University of Rhode Island (URI) for herpetological inventories and science communication needs, the Virginia Institute of Marine Science (VIMS) and the Seagrass Ecology Lab at SUNY Stony Brook in New York for estuarine water quality and seagrass monitoring. Because NCBN parks were severely affected by Super Storm Sandy in 2012, funding was provided from Superstorm Sandy Recovery/Construction and Resiliency funds in 2013-2014, to assure implementation of estuarine nutrient enrichment and seagrass monitoring for contiguous years at FIIS for 2013-2016 field seasons. SeagrassNet and bay-wide monitoring occurred at FIIS in 2015 to help evaluate the impacts of Super Storm Sandy on water quality in the bay. Ocean shoreline position monitoring continued during both fall 2014 and spring 2015 at FIIS, GATE, ASIS, GEWA, SAHI and CACO, following the network's published protocol.

This year, because of the retirement of the North Atlantic Coast CESU Coordinator, Charles Roman, the NCBN Program Manager, Sara Stevens, took over the management of all Hurricane Sandy science projects for the NE Region, over \$21,000,000 in Hurricane Sandy projects for FIIS, ASIS, GATE and CACO. These projects are due to be completed in the spring 2017, with some continuing throughout 2017.

II. Accomplishments

Inventories

- University of Rhode Island scientists conducted a herpetological inventory at COLO in early spring-summer 2016. Survey methods employed at COLO in 2016 replicated those used in a previous NCBN inventory (2001-2003) so that comparisons of herpetofaunal diversity can be made over time. Additional methods were used to increase the probability of finding hard to detect amphibians and reptiles in the park. Data summary and report available 2017.
- NCBN Biotech, Dana Filippini continued bird surveys at SAHI and entered the data. The inventory method is based on the MIDN forest bird monitoring protocol.
- The NCBN Data Manager and Research Associate, Thom Curdts, continued to work with Natureserve on the vegetation mapping report for ASIS. Final peer-review for the vegetation mapping report for ASIS was completed and comments have been returned to Natureserve. All other data and mapping products for ASIS are complete; NCBN staff continue to work closely with the cooperator in completing and publishing the report.

Vital Signs Monitoring

Forest vegetation monitoring (GEWA, THST, COLO)

- A four-person field crew shared with MIDN and NETN conducted forest health monitoring at three NCBN parks (GEWA, THST, COLO). This represents the eight year of sampling at GEWA and THST, and the sixth year at COLO.

Ocean shoreline position monitoring (FIIS, ASIS, CACO, GATE, GEWA, SAHI)

- Shoreline monitoring (1D) continued to be collected by NCBN and Park Staff for fall and spring shorelines at ASIS, CACO, GATE, SAHI, GEWA, and FIIS. Rutgers' scientists under an NCBN/CESU task agreement continued to conduct the monitoring for the Network at GATE.
- Two GeoCorp Interns were hired by NCBN to assist at GATE under the supervision of Dr. Norb Psuty. The interns collected shoreline and topographic monitoring data for the Network and Hurricane Sandy projects and assisted with data analyses and report preparation.
- Members of the NCBN Coastal Geomorphology Monitoring Science Advisory Committee met at URI in March 2016 to discuss the Shoreline Position Change and Coastal Topography Monitoring protocols. Representatives from Rutgers University, park staff (ASIS, CACO), other coastal Networks (GULN, SECN) and NCBN staff met for two days to discuss relevant changes in technologies and potentially methodologies.

Coastal topography monitoring (GATE)

- Rutgers collaborators expanded 3D monitoring at GATE to include Miller Field, Riis Park, and Aviation Road with future plans to include Fort Tilden. The data are used to provide metrics on the post-Sandy adjustment and resilience of the coastal system on both a site-specific and regional basis.

Marsh Bird monitoring (CACO, COLO, GATE)

- Marsh Bird monitoring was implemented for the second time at GATE this year, April-July, 2016, and continued at CACO for the 5th consecutive year, COLO for the 4rd consecutive year.
- Eight volunteers were trained on how to collect the marsh bird data.
- NCBN Data Manager and Marsh Bird Project Lead continued discussions with SHARP and FWS personnel concerning the possibility of developing shared marsh bird

monitoring database. The SHARP program will be developing a database that NCBN will adopt.

Salt marsh vegetation and nekton monitoring (ASIS, COLO, GATE-SHU)

- 2016 was the fifth year that salt marsh monitoring was conducted at ASIS and COLO (initiated in 2008). It was the fourth year of monitoring at GATE-SHU (initiated in 2010).
- One Pathways Intern (East Carolina University graduate student), one Biological Technician, and two GIP interns were stationed at ASIS and completed the sampling under the supervision of NCBN staff. Data entry for the 2016 field season and initial QAQC has also been completed. Data will undergo final quality control procedures this winter prior to analysis for the annual data summary reports.
- The salt marsh field crew was required to review and discuss the safety procedures with the Project Leader (Erika Nicosia Rocks) as well as the crew leader prior to conducting any field work during the 2016 season. This included discussions regarding checking in and out each day, driving while on official travel, and ensuring that they had emergency contact numbers saved to their phones. Also, if there was any kind of change in logistics (accessibility, weather, beach conditions, and site hazards) the crew took the time to discuss the safety concerns and changed their course of action as necessary. In addition to remaining in close contact with Erika regarding any changes to the field schedule, the crew also worked closely with park staff to ensure that all safety procedures were followed.
- All data from the 2015 sampling season at FIIS and SAHI have been summarized in the annual data summary reports, available on the NCBN website.
- NCBN staff and USGS scientists received funding from USGS NPMP in FY13 for a three-year project entitled "Development of a Multimetric Index for Integrated Assessment of Salt Marsh Condition in the Northeast Coastal and Barrier Network." This project was completed in the spring of 2016. USGS collaborators presented the results to NCBN staff in May 2016, and are in the process of drafting a manuscript for publication.

Salt marsh surface elevation monitoring (NCBN Parks CACO, GATE, FIIS, ASIS, COLO; NETN Parks ACAD, BOHA; NCRN Parks NACE, GWMP)

- 95 SET monitoring stations at five NCBN parks (GATE, FIIS, CACO, ASIS, COLO) were sampled in the fall and spring of FY16.
- 19 SET stations at two NCRN parks (NACE, GWMP) were sampled in the fall and spring of FY16 in collaboration with the NCRN.
- 22 SET stations at two NETN parks (BOHA, ACAD) were sampled in the fall and spring of FY16.
- 6 new SET monitoring stations were installed in FY16 at CACO to replace older SETs installed in the 1990's which are deteriorating.
- 3 new SETs installed at ASIS in support of a new SET project comparing the measurement of elevation change in a salt marsh using three different techniques.
- Data from all NER SET sites were entered and validated in SET database.
- Water level recorders were monitored at GWMP, COLO, ASIS, GATE, FIIS and ACAD during FY16. These are being used to characterize the tidal patterns and differences in marsh flooding at the various SET sampling stations within each park.
- Conducted static and RTK surveys of the SETs and other infrastructure at CACO, FIIS and COLO. Re-surveying all SET monitoring stations based on the guidelines and SOPs in SET

protocol.

- Permanent 1m² vegetation plots were established at FIIS, GATE and CACO in support of the long term monitoring occurring at the SET monitoring stations.

Estuarine nutrient enrichment (ENE) monitoring (FIIS, CACO, GEWA, COLO, ASIS) -

- NCBN collaborators from the Virginia Institute of Marine Sciences (VIMS) and Stony Brook University continued to collect estuarine water quality data for the NCBN based on the network's Estuarine Nutrient Enrichment (ENE) protocol. Water quality monitoring occurred at CACO, COLO, ASIS, GATE and FIIS this year. All stations were successfully sampled. Chlorophyll samples were sent to Cape Cod National Seashore North Atlantic Coast Laboratory for analyses. Results have been returned to VIMS and Stony Brook. Digital copies of all data were created.
- Water quality data collected in 2016 at FIIS in connection with the NCBN Estuarine Nutrient Enrichment (ENE) Monitoring program have been entered into the central database and are awaiting QC. Data collected at ASIS, CACO, and COLO are still being entered by park staff and cooperators and are expected by the end of the calendar year. Data management staff is currently implementing newly revised QC methodologies developed by USGS and EPA collaborators to address a backlog of monitoring data (2012 – present). Upon certification, data will be rolled up to STORET using Electronic Data Deliverable (EDD) tools developed by NCBN in cooperation with WRD staff. In addition to discrete monitoring data, the ENE program also collects some continuous data throughout the sampling season for QC purposes. Staff are actively revising the program's methods for QC-ing and managing these continuous data such that they are handled exclusively in AQUARIUS.
- The following park/years data are undergoing QC/certification now and will be prepared for upload to STORET using our EDD tools. Final publication to STORET will presumably have to wait until final deployment of EQUIS by WRD.

ASIS - 2012, 2014, 2016

COLO - 2012, 2014, 2016

GATE - 2012, 2014

CACO - 2012, 2013, 2014, 2016

FIIS - 2013, 2014, 2015, 2016

GEWA - 2013, 2015

Seagrass monitoring (CACO, FIIS, ASIS)

- Stony Brook personnel conducted the park-wide rapid seagrass assessment from July 2 to July 31, 2016, visiting 198 locations within Great South Bay. Data were quality controlled and entered into the NCBN database.
- Stony Brook personnel also successfully performed the summer NCBN SeagrassNet survey. Biomass samples were collected and processed. All data was digitized, and will be entered into the SeagrassNet database, fall 2016. VIMS cooperators completed the Seagrass Net survey at ASIS.

Data Management

- NPSpecies Updates--NCBN staff assisted IMD and several parks in adding/updating species profiles (ASIS, CACO, COLO, GEWA).
- At the request of NRSS staff, NCBN staff assisted with NPS Centennial BioBlitz activities, documenting several dozen species at ROWI using the iNaturalist mobile application.

- IRMA Updates--NCBN staff added 36 new/updated datasets to IRMA, most with associated tabular or spatial data holdings or published reports. Data Management staff also provided IRMA assistance to regional and park staff (NER GIS, GATE), as well to as URI cooperators working on Hurricane Sandy-related projects. Continued to assist Park staff on making their legacy IRMA references, holdings publicly accessible.
- NCBN Data manager served as lead on a successful collaboration with CACO, NETN, MBD/WASO to upgrade existing NCBN saltmarsh database to meet new IMD Database Standards, one of the first I&M Networks to do so. The database was successfully field tested this season.
- NCBN staff representing the Network at an NER/NCR Water Quality Collaboration Meeting in Front Royal, VA explored and discussed the best practices for maintaining NCBN continuous monitoring data in the NPS enterprise version of AQUARIUS.
- NCBN Data Manager worked with GEWA natural/cultural resource staff, NER archeologists, and NPS paleontologists in implementing a protocol for monitoring paleontological and cultural artifacts along the shoreline and cliffs of GEWA as part of a long-term effort to monitor/address issues of erosion and vandalism at the park's bluff resources. Together, the team adopted and tested a monitoring plan that could be combined with the parks existing shoreline monitoring activities.
- NCBN Data Manager provided park management (GEWA, SAHI) with shoreline, species, and other data in order to quickly address pressing management issues (e.g., assisted NER PM and GEWA staff investigating possible impacts of construction of an artillery siting area at the park).

Monitoring Protocol Development

- The NCBN SET protocol was published this year at the beginning of FY16.
- Work on the Salt Marsh Bird monitoring protocol continued with a draft submitted for review to the NCBN program manager. Because we no longer have a marsh bird monitoring lead, protocol development is on hold.
- Work on the Salt Marsh Vegetation protocol continues in collaboration with the protocol authors. The protocol has been peer reviewed and comments are being addressed. This protocol will be finally published in the spring of 2017.

Science Communication

NOTE: See attached Outreach Stories with links to additional science communication products.

- "Building community consensus about climate change resilience." Resource brief. Northeast Coastal and Barrier Network, National Park Service. 2016.
- "Virtual experiments guide resilience planning in Jamaica Bay." Resource brief. Northeast Coastal and Barrier Network, National Park Service. 2016.
- "The Fire Island Wilderness Breach: Shifting Shorelines and Shoals." Resource brief. Northeast Coastal and Barrier Network, National Park Service. 2016.
- "The Fire Island Wilderness Breach: Ecological Resilience in Great South Bay." Resource brief. Northeast Coastal and Barrier Network, National Park Service. 2016.
- "Films to Promote Unity and Healing: Filmmaker Sarah Gulick Engages People in the Science Behind Resilience." Researcher profile. Northeast Coastal and Barrier Network, National Park Service. 2016.
- "The Big Reveal: Developing Habitat Maps of the Seafloor of Key Coastal Natural

Resources.” Photostory. Northeast Coastal and Barrier Network, National Park Service. 2016.

- “URI researchers, students team up with National Park Service to map underwater habitats post-Hurricane Sandy.” Press release. Northeast Coastal and Barrier Network, National Park Service. 2016.
- “Long term monitoring provides key data on the impact of storms.” Resource brief. Northeast Coastal and Barrier Network, National Park Service. 2016.
- “Can hungry box turtles help control invasive fruiting plants?” Resource brief. Northeast Coastal and Barrier Network, National Park Service. 2016.
- “Hurricane Sandy Coastal Resiliency Science” ArcGIS StoryMap. Developed by Sara Stevens, Thom Curdts and Kristen Hychka. <http://arcg.is/1KY1EpT>

Planning/Park and Regional Integration

- NCBN SET project lead, Jim Lynch, along with NCR staff, and USFWS staff collaborated on the design of a new enterprise database being developed with the help of the I&M staff in Ft. Collins, CO. This database is to be used by SET users in both the NPS and USFWS for storing, validating and analyzing SET and marker horizon data.
- NCBN SET project lead, Jim Lynch, assisted Dr. James Morris (Univ. of South Carolina) and a post-doctoral student, Dr. Katherine Renkin, with RTK surveying and biomass samples at FIIS and ASIS as well as for the USFWS at Chincoteague NWR in support of their Hurricane Sandy salt marsh resiliency and modeling project funded by both agencies.
- NCBN SET project lead, Jim Lynch, collected SET data for two NETN parks and two NCR parks.
- NCBN staff monitored additional water level gauges deployed at ASIS and FIIS in support of the Hurricane Sandy salt marsh resiliency and modeling project being conducted by the University of South Carolina.
- NCBN Data Manager, Dennis Skidds, assisted GRD in developing an integrated plan for monitoring artifacts along the shoreline and cliffs of GEWA. GEWA is currently addressing management issues concerning the parks’ vulnerable paleontological and cultural resources along the eroding bluff face on the Potomac River. During shoreline change monitoring field data collection, NCBN staff have agreed to partner with GRD and GEWA to collect paleontological monitoring data at the same time. This effort was developed and piloted at the park.
- NCBN Data Manager, Dennis Skidds continued to serve as a technical resource for staff from GUIL, GULN, and SECN as they implement the NCBN Shoreline Position Change Monitoring protocol in their Networks.
- A URI cooperator and NCBN Data Manager travelled to FIIS to train seasonal staff and collaborate on data collection and data management protocols related to ongoing breach shoreline monitoring activities at the park. Final versions are currently in revision and will be published in FY17.
- NCBN Program Manager, Sara Stevens, continues to work with FIIS interpretive staff to handle science communication needs related to Hurricane Sandy and the FIIS Wilderness Breach.
- NCBN Program Manager, Sara Stevens, represents the NPS on a multi-DOI agency working group and executive calls along with NER ARD, Frank Hays, and fulfills requests

for NPS Hurricane Sandy data and information as needed.

Safety

- Members of the 2016 salt marsh field crew were able to participate in the operational leadership training offered at ASIS at the beginning of the field season.
- The NCBN Safety Google Site is kept up-to-date by staff member, Erika Nicosia Rocks. Each NCBN staff member is in charge of one or more parks to stay in contact with their safety officers and kept aware of any park-related changes or new policies.
<https://sites.google.com/a/nps.gov/ncbn-safety/home>

III. Key Highlights

Youth and Volunteer Hours Supported by NCBN (Approximately 12,936 hours)

- 1 Pathways student- NCBN salt marsh monitoring program. Hours: 480
- 2 GIP Interns- NCBN salt marsh monitoring program Hours: 560
- 2 GIP Interns- NCBN Geomorphological monitoring program at GATE, stationed at Sandy Hook, mentored by NCBN cooperators from Rutgers. Hours: 560
- 1 University of Rhode Island Coastal Fellow-140
- 6 University of Rhode Island Students-working on NCBN science communication, FIIS/COLO herpetological inventories, NCBN remote sensing project. Hours: 6,240
- 3 University of Rhode Island Research Assistants - working on NCBN science communication, FIIS/COLO herpetological inventories. Hours: 5,460
- 10 marsh bird monitoring citizen science volunteers. Hours: 80

Sediment Elevation Monitoring Protocol

The NCBN SET protocol is a collaborative document authored by SET users from the NPS, USGS and NOAA. It is intended for all types of SET users including those in academia, the government and private sector. It has been adopted by I&M Networks in the NER and NCRN, and has also been adopted by the USFWS. Efforts are underway to develop an enterprise database for use by NPS and USFWS SET users to consistently store and analyze the data collected at the SET monitoring stations.

Climate Change Related Monitoring and Additional Projects

- Sara Stevens continued to work on a multi-agency, collaborative effort to collect and share data regionally, both related to NCBN and Hurricane Sandy data and projects.
- The salt marsh elevation and modeling project is a Hurricane Sandy funded project managed by the Sara Stevens and Holly Plaisted from CACO. The outcome of this project will include climate change and sea-level rise models and scenarios for CACO, GATE, ASIS, and FIIS salt marshes. Dr. Jim Morris, University of South Carolina is the PI on the project.
- A network of water level monitoring instrumentation was deployed at CACO, FIIS, GATE and ASIS, and maintained by Jim Lynch to enhance the NCBN salt marsh monitoring program and Hurricane Sandy modeling efforts.
- Sara Stevens established an IA with USGS in FY15 to install and maintain both a tide gauge and weather station at FIIS. In FY16, with assistance from FIIS staff, locations for the gauge and weather station were agreed upon, and both were installed and are now fully operating. This gauge and weather station fill a long-term gap in local tide and weather information for the Great South Bay and Fire Island NS.

- The NCBN Program Manager worked with NOAA to assure maintenance and repairs occurred on a critical NOAA tide gauge on Cape Cod that is used to support many park and Network projects. In discussions over many years with NOAA, they have agreed to include the gauge in the NWLON network of permanent tide gauges with yearly maintenance paid for by the NPS, this is due to the efforts of Lynda Bell, previously working for NPS Ocean and Coastal Resource Branch. Linda greatly assisted the Network in negotiating and partnering with NOAA.
- In order to enhance the salt marsh/sea level and climate modeling effort for ASIS and FIIS, NCBN collected additional data related to sediment on marshes at ASIS and FIIS, sediment cores had been collected at GATE as part of a park-specific project.
- Sara Stevens, along with Amanda Babson, in collaboration with USGS scientists, Neil Ganju submitted an NRPP proposal to better understand sediment flux within NCBN parks. The four parks included in this study are all part of a larger Hurricane Sandy resilience project studying salt marsh vulnerability, that Sara is project lead on. This project will provide a better understanding of sediment sources and fluxes within these parks, and provide important data that can be included in the marsh equilibrium models used to look at long term condition of salt marsh.

Hurricane Sandy Project Management

- NCBN Program Manager, Sara Stevens, manages over \$21,000,000 in Hurricane Sandy funded projects for the Northeast Region.

Communications & Reporting

Publications

- Duhaime, R., J. Cressman, and E. Tefft. 2016. Using GeoJot during future storm events: A standard operating procedure for NPS resource managers and READ personnel. Natural Resource Report NPS/NCBN/NRR—2016/1123. National Park Service, Fort Collins, Colorado. <https://irma.nps.gov/DataStore/Reference/Profile/2227260>
- Gobler, A. B., and J. Thickman. 2016. Response of indicator bacteria in Great South Bay, Long Island to the breach at Old Inlet: An analysis of coliform bacteria post Hurricane Sandy. Natural Resource Report NPS/NER/NRR—2016/1261. National Park Service, Fort Collins, Colorado. <https://irma.nps.gov/DataStore/Reference/Profile/2230810>
- Lynch, J. C., P. Hensel, and D. R. Cahoon. 2015. The surface elevation table and marker horizon technique: A protocol for monitoring wetland elevation dynamics. Natural Resource Report NPS/NCBN/NRR—2015/1078. National Park Service, Fort Collins, Colorado. <https://irma.nps.gov/App/Reference/Profile/2225005>
- Nicosia, E. L. 2015. Monitoring salt marsh vegetation and nekton at Fire Island National Seashore and the William Floyd Estate: 2015 summary report. Natural Resource Data Series NPS/NCBN/NRDS—2015/995. National Park Service, Fort Collins, Colorado. <https://irma.nps.gov/App/Reference/Profile/2225367>
- Nicosia, E. L. 2015. Monitoring salt marsh vegetation and nekton at Sagamore Hill National Historic Site: 2015 summary report. Natural Resource Data Series NPS/NCBN/NRDS—

2015/996. National Park Service, Fort Collins, Colorado.
<https://irma.nps.gov/App/Reference/Profile/2225387>

- Psuty, N. P., W. Schmelz, A. Spahn, D. Riddell, K. Ames, and K. Nicholas. 2015. Northeast Coastal and Barrier Network shoreline position (1D) and coastal topographic (2D) change monitoring: 2012-2013 annual data summary report for Gateway National Recreation Area. Natural Resource Data Series NPS/NCBN/NRDS—2015/992. National Park Service, Fort Collins, Colorado. <https://irma.nps.gov/App/Reference/Profile/2225288>
- Psuty, N. P., W. Schmelz, A. Spahn. 2015. Northeast Coastal and Barrier Network coastal topographic change monitoring: 2010-2011 annual data summary report for Gateway National Recreation Area. Natural Resource Data Series NPS/NCBN/NRDS—2015/993. National Park Service, Fort Collins, Colorado.
<https://irma.nps.gov/App/Reference/Profile/2225290>
- Psuty, N. P., W. Schmelz, C. P. Carvajal, and A. Spahn. 2015. Northeast Coastal and Barrier Network coastal topographic change monitoring: 2011-2012 annual data summary report for Gateway National Recreation Area. Natural Resource Data Series NPS/NCBN/NRDS—2015/994. National Park Service, Fort Collins, Colorado.
<https://irma.nps.gov/App/Reference/Profile/2225295>
- Psuty, N. P., W. Schmelz, A. Spahn, D. Riddell, K. Ames, and K. Nicholas. 2016. Northeast Coastal and Barrier Network shoreline position (1D) and coastal topographic (2D) change monitoring: 2013-2014 annual summary report for Gateway National Recreation Area. Natural Resource Data Series NPS/NCBN/NRDS—2016/1000. National Park Service, Fort Collins, Colorado. <https://irma.nps.gov/DataStore/Reference/Profile/2226167>
- Psuty, N. P., K. Ames, and A. Spahn. 2016. Northeast Coastal and Barrier Network shoreline position (1D) and coastal topographic (2D) change monitoring: 2014-2015 annual summary report for Gateway National Recreation Area. Natural Resource Data Series NPS/NCBN/NRDS—2016/1003. National Park Service, Fort Collins, Colorado.
<https://irma.nps.gov/DataStore/Reference/Profile/2227181>
- Psuty, N. P., J. Schmelz, M. Towle, and A. Spahn. 2016. Shoreline change monitoring at Gateway National Recreation Area: 2007-2012 trend report. Natural Resource Data Series NPS/NCBN/NRDS—2016/1030. National Park Service, Fort Collins, Colorado.
<https://irma.nps.gov/DataStore/Reference/Profile/2230106>
- Ullman, D., A. Babson, and M. Bradley. 2016. Evaluating VDatum in coastal national parks: Fire Island National Seashore, Gateway National Recreation Area, and Assateague Island National Seashore. Natural Resource Report NPS/NCBN/NRR—2016/1148. National Park Service, Fort Collins, Colorado. <https://irma.nps.gov/DataStore/Reference/Profile/2227750>

Public & Professional Engagement

Presentations

- Bradley M. Ransmussen, S. Neil A. Raphael J and Stevens S. Precision elevation mapping at critical park areas at Fire Island National Seashore. Fire Island National Seashore Science Conference, June 2016.
- Lynch J., Nicosia E., Filippini D., Rasmussen S., Neil A., Stevens S., and Skidds D. Long Term Salt Marsh Monitoring at Fire Island National Seashore by the Northeast Coastal and Barrier Network, Inventory and Monitoring Program. Fire Island National Seashore Science Conference, June 2016.
- Lynch, J.C., D.R. Cahoon and P. Hensel. Development of the Surface Elevation Table (SET) protocol document. Coastal & Estuarine Research Federation Conference. November 8-12, Portland, OR.
- Lynch, JC. Monitoring of wetland elevation change and hydrology at coastal parks in the northeast United States. NPS I&M Program Webinar Series, August 2016.
- Neckles H, Glenn R. Guntenspergen, Nagel J, Nicosia E, Skidds D, Schoolmaster D Jr., Stevens S, and James B. Grace. A multimetric index for integrated assessment of salt marsh ecosystem condition. CERF 2015. Portland OR, 8-12 Nov. 2015.
- Skidds, D.E., 2016. GIS in emergency preparedness and response: Lessons learned from Hurricane Sandy. Annual Scientific Support for Environmental Emergency Response (SSEER) Workshop, Narragansett, RI.
- “Best Poster” Award Winner - Skidds, D.E., H. A. Neckles, G. R. Guntenspergen, J. L. Nagel, E. Nicosia, D. R. Schoolmaster, S. Stevens, and J. B. Grace, 2015. Use of GIS in the Development of a Multimetric Index (MMI) for Integrated Assessment of Salt Marsh Condition in Northeastern Coastal National Parks. Annual Northeast Arc Users Group Conference, Burlington, VT.
- Skidds, D.E., 2016. Use of ArcGIS Online for Managing and Sharing Geospatial Data for Coastal Storm Response. 2016 FWS/NPS Geospatial Training Workshop, Shepherdstown, WV.
- Stevens, S. The NPS Inventory and Monitoring Program-Student Opportunities. Guest Lecture, University of Rhode Island, Natural Resource Science Department, Oct 2016.
- Stevens, S. Evaluation of Hurricane Sandy Coastal Resilience Program, NPS contribution. Update to the Department of the Interior. July 2016.
- Stevens, S. Building Resilience in the Wake of Hurricane Sandy, What We’ve Learned. NPS contribution. Briefing for the Office of Management and Budget. May 2016.
- Stevens, S. A Scientist’s Aerial Documentation of the Fire Island Wilderness Breach. Contribution to DOI Hurricane Sandy 4th Anniversary Campaign. Sept 2016.
- Stevens, S. Exciting Habitat Changes Occurring Along Fire Island National Seashore: The National Park Service Monitors Ecosystem Change in the Great South Bay. Contribution to DOI Hurricane Sandy 4th Anniversary Campaign. Sept 2016.
- Stevens, S. Preparing for Future Storms: Web Mapping Applications to Support Storm Event Response. Contribution to DOI Hurricane Sandy 4th Anniversary Campaign. Sept 2016.

Stevens, S. National Park's Submerged Habitat Mapping: New Information for Parks.
Contribution to DOI Hurricane Sandy 4th Anniversary Campaign. Sept 2016.

Outreach Activities

- Jim Lynch, NCBN SET monitoring lead, assisted numerous groups with SET and surveying assistance and implementation of the NCBN protocol. Jim held conference calls on SET and surveying with NPS colleagues in the SECN and staff from the Timucuan Ecological and Historic Preserve in Jacksonville, Florida. Jim also provided surveying assistance to the Smithsonian Ecological Research Center in Edgewater, MD, as well as providing assistance to USGS, PWRC with surveying at the USFWS Blackwater NWR.
- Sara Stevens wrote numerous project "highlight" documents, providing photos, web links, etc. for use by DOI at various Hurricane Sandy events.
- NER Hurricane Sandy google website (developed and maintained by Sara Stevens)--posting of all Hurricane Sandy project proposals, progress reports, resource briefs, photos, etc.
- NER Hurricane Sandy Science Story Map (developed and maintained by Sara Stevens and Thom Curdts)--posting of all science communication materials developed for Hurricane Sandy Projects
- NER Hurricane Sandy Science Flickr Site (developed and maintained by Erika Nicosia-NCBN employee)

Teaching and Advising Students and Interns

- Sara Stevens is a guest lecturer for the Natural Resources Science Department Senior Colloquium at the University of RI. The colloquium includes ethics in science and developing a professional resume and cover letter, and interviewing techniques.
- Sara Stevens is a guest lecturer for the Natural Resource Science Department at URI to present the I&M program, and future NPS opportunities and employment.
- All NCBN staff mentor both undergraduate and graduate students in the Department of Natural Resources Science at the University of Rhode Island on an ongoing, year-round basis.
- Robin Baranowski, NCBN term Biotech provided plant identification support to the fall URI Biological Sciences Dept., field botany course for seniors and graduate students.
- Dennis Skidds co-teaches an advanced surveying techniques seminar class at URI along with the NER Region GIS Coordinator, Nigel Shaw.

Innovation

Data Management:

- NCBN Data Manager Dennis Skidds worked with GEWA natural/cultural resource staff, NER archaeologists, and NPS paleontologists in implementing a newly designed protocol for surveying paleontological resources at the Park's extensive bluffs along the Potomac River. Adapted by NPS paleontologists Vincent Santucci and Justin Tweet from a similar protocol written for cliffs resources at Point Reyes National Seashore, the GEWA protocol aims to formally document the extent and rate of loss of these artifacts, as well as to monitor/address issues of vandalism of the bluff resources. The surveys will coincide with the Network's shoreline position change monitoring fieldwork, which takes place each

spring and fall. During testing this fall, Dennis and park staff documented several dozen fragments of bone and wood, as well as impressions left by shells and other fossils. They also noted evidence of illegal fossil removal and vandalism of the bluff face. The data recorded will serve as a baseline for further monitoring and will inform park resource management and law enforcement decisions. In support of these efforts, Dennis also designed and began evaluating two mobile field data collection applications: one using forms created in FilemakerPro, the other designed using an ESRI ArcGIS Online web mapping application and the ESRI Collector app.

Safety:

- Erika Nicosia Rocks, NCBN Salt Marsh monitoring lead developed an NCBN Safety Google Site that she manages and keeps up-to-date. Documents relevant to each monitoring protocol and each Network park are stored on this site, which is then easily accessible to all NCBN staff, including summer seasonals. In addition, each NCBN employee is in charge of staying in contact with park safety officers for one or more assigned Network parks to be able to stay on top of any park-related changes or new policies. Link to NCBN Google Site: <https://sites.google.com/a/nps.gov/ncbn-safety/home>

General Budget Assessment

Account	Description	Authorized	Expended	Balance
PPNENEIM1C/ PPMRSNR1Y.AM0000	Vital Signs	\$800,000	\$798,372	\$1,628
PPNENEIM1C/ PPMRSNR1Y.AM0000	IMD-H Sandy Support	\$75,000	\$75,000	0.00
PPNENEIM1C/ PPMRSNR1N.NR0000	WRD	\$82,300	\$82,300	0.00
TOTAL		\$957,300		

2016 Expenditures compared to original Workplan

Differences between the budget proposed in the NCBN FY2016 Annual Work Plan and the final budget presented here include:

Personnel

- Total salary costs were \$10,818 less than originally budgeted, primarily due to loss of a permanent employee.
- Travel funds were within \$787.00 of the Network's travel ceiling of \$33,000.
- Operations and equipment costs were respectively, \$26,351 less than and \$8,649 higher than was budgeted for in the work plan due to additional funds available as a result of lower expenditure in travel funds. These funds went to purchasing and repairing water monitoring equipment and GPS/RTK equipment for SET and elevation monitoring and other needs to support infrastructure for long-term monitoring.

Cooperative Agreements (\$195,695 (Vital Signs) + \$75,000 (IMD Assist) Cooperative agreement costs were \$22,022 higher than reported in the work plan due to lapsed salary and

hiring an intern vs a biotech for the salt marsh monitoring crew.

- \$59,954 (NCBN Funds) Virginia Institute of Marine Science (VIMS) Upgrade of YSI Equipment and additional monitoring support for sediment sample collection and analysis.
- \$59,153 (WRD Funds) Virginia Institute of Marine Science (VIMS) Water quality and Seagrass monitoring-ASIS, COLO, GEWA
- \$7,863 Stony Brook University (WRD Funds) Water quality monitoring-GATE
- \$28,232 Rutgers University, Shoreline Mapping, GATE.
- \$40,493 University of Rhode Island, Science Communication Support for Hurricane Sandy Projects managed by NCBN.
- Additional IMD Funding to support Hurricane Sandy project data management: \$75,000 Colorado State University

Equipment

- Total equipment and operations costs were \$20,478, \$29,522 less than what was estimated in the work plan, but \$22,022 of this went to the cooperative agreement with VIMS to upgrade YSI equipment.

Annual Expenditure on water quality/quantity monitoring (WRD and Vital Signs Funding)

- During FY14-FY16 our cooperative agreement with SUNY Stony Brook to implement our WQ monitoring at FIIS, was fully funded through Hurricane Sandy Mitigation Funds. This funding is now no longer available. In FY16 we had to purchase a number of new YSI Sondes, these costs are included in the above budget numbers. We still need to purchase at least two more instruments which will cost approximately \$50,000. Annually our WQ monitoring cost (with no equipment costs included) is approximately \$116,000, but this does not include WQ monitoring at CACO which is paid for out their I&M Program budget. WRD funding provided in FY16 was \$82,300.

Additional funds leveraged by the Network in FY16

The national I&M Division (IMD) provided an additional \$75,000 in funding support to the Network for the management of multiple Hurricane Sandy funded projects that the Network Program Manager is lead on. This funding was put into a cooperative agreement in FY16 with Colorado State University to fund one research associate to support data management and outreach activities related to these additional projects.

The network also leverages resources by sharing its forest monitoring crew with the Mid-Atlantic Network (MIDN) and the Northeast Temperate Network (NETN). Sharing a field crew and protocol allows the networks to share on administrative and data management costs, and attract more skilled technicians for the monitoring crew.

Outreach Examples: Developed by NCBN Program manager to support DOI's Hurricane Sandy 4th Anniversary Campaign

A Scientist's Aerial Documentation of the Fire Island Wilderness Breach

The storm surge and high waves that occurred during Hurricane Sandy caused barrier island breaches across eastern Fire Island, Long Island and one on the Westhampton barrier beach just east of Moriches Inlet. Two of the breaches were immediately closed by USACE, but the Wilderness breach on Fire Island National Seashore, one having the greatest impact on the back bay areas of Great South Bay, was left untouched and open to the ocean by the National Park Service.

The wilderness portion of Fire Island is narrow and has a long history of breaches and inlets. An inlet was last documented near this location in 1825. How this recent breach has been evolving and what impact it has had on the back bay and mainland of Long Island are questions being answered by the National Park Service. Through scientific studies to monitor things like water quality, seagrass, water temperature, bacteria counts, and species in the Bay following Hurricane Sandy, the NPS hopes to better understand how breaches affect the resiliency of coastal systems and to inform best management practices in the future.

One monitoring project entails collecting aerial photography of the transformation and evolution of the Wilderness Breach since its creation during Hurricane Sandy. Dr. Charles Flagg from Stony Brook University has been flying a small airplane over the breach and recording its characteristics and change since the storm in 2012. As part of an effort to document the research being conducted around the breach, the NPS is working with filmmakers from Harper's Ferry Center to develop a number of short videos to share and help inform the public. One of the first films to be completed in 2016 is a profile of Dr. Flagg's research on the breach.

This is a short social media film, designed to help humanize the science efforts and to start reframing conversations about the breach by providing a (literally) new perspective and showing its natural beauty. Additional films are being developed to highlight the exciting diversity of coastal resilience research being conducted and is one of the many NPS Hurricane Sandy resiliency projects.

<https://youtu.be/oTSTsHx-KNQ>

Photos of the Fire Island Breach

<https://www.flickr.com/photos/npsncbn/albums/72157658332281778>

Story about the filmmaker, Sarah Gulick

<http://nps.maps.arcgis.com/apps/MapSeries/index.html?appid=d953beffd6704440bb2464283e7bd740>

National Park's Submerged Habitat Mapping: New Information for Parks

Scientists are exploring the submerged marine habitats of four coastal parks within the northeast region to gather comprehensive data to build baseline habitat maps never developed before, that will be used to understand how these resources are changing in response to storms, sea-level rise, ocean warming, and other factors to promote the implementation of effective protection and management strategies.

Research teams from the University of Rhode Island, University of Delaware, Rutgers University and Cape Cod Center for Coastal Studies have been conducting submerged habitat mapping studies within four coastal parks in the northeast region – Fire Island National Seashore, Assateague Island National Seashore, Gateway National Recreation Area, and Cape Cod National Seashore. Between 2014 and 2016, these research teams collected sidescan and bathymetry data totaling over 160 sq km at numerous study areas. In addition, over 1,000 ground-truth samples were collected, consisting of sediment and biological grab samples and underwater photographs and videos. These data are now being processed and analyzed to construct habitat classification maps to allow NPS to better understand these habitats, promote resource stewardship, inform management decisions.

Though these projects are not yet complete, there are many interesting preliminary findings being revealed. For example at Fire Island National Seashore, the scientists discovered new mussel beds during their survey of the area east of the new Old Inlet breach, a very unexpected and interesting discovery for the area. The sidescan imagery showed a unique-looking bottom type, which was discovered to be a large, dense bed of mature blue mussels. Because of their size and maturity, the research team believes the mussel set shortly after Hurricane Sandy, likely as a result of improved water quality in the area with the flushing of the bay from the open ocean breach.

As part of the NPS Hurricane Sandy communication effort being conducted by science writers at the University of Rhode Island, a new photo story has been developed to inform managers and the public about these projects. This photo story focuses on the Submerged Habitat Mapping efforts at Fire Island National Seashore and Assateague Island National Seashore:

Photo Story:

<http://arcg.is/1XJaWOU>